Income Unfairness and Occupational Choice

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21 October 2016

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May 31, 2017

Abstract

In this paper, we reassess labor-market adjustment using an indicator of occupational income unfairness (OIU) that shows whether workers are paid what is warranted by their effort. Although an empirically derived unfairness indicator does not necessarily reflect workers' perceived unfairness, OIU values in some occupation groups such as professionals, sales, and production have stabilized around zero over the past 24 years. This indicates the existence of a labor-market adjustment mechanism in such occupation groups. We use contribution analysis to find that the stabilization of OIU is largely explained by changing education level and work hours with the aging effect and the gender effect having only small effects on unfairness.

JEL classification: D63; J24; J31

Keywords: Income Inequality; Unfair Inequality; Occupational Choice

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1   Introduction

There is a large literature documenting rising income inequality in most developed countries since the 1980s. The main explanation for this phenomenon is that the demand for skills has outgrown the supply of high-skilled workers to increase the skills premium (Katz and Autor (1999)). Although, according to neoclassical economic theory, the labor market adjusts to reduce such income inequality in the long run, this mechanism does not seem to be working. On the demand side, the skills-biased technical change (SBTC) hypothesis helps to explain the failure of this adjustment mechanism (Acemoglu and Autor (2011)).

On the supply side, Autor, Katz and Kearney (2006) and Autor, Katz and Kearney (2008) indicate the slowdown of supply of high-skilled workers. They focus on a divergence of upper-tail and lower-tail wage inequality. They find that the upper half (90–50) wage differentials continuously increased from the late 1970s. In contrast, the lower half (50–10) wage differentials increased until the late 1980s and stagnate thereafter. These contrasting behaviors account for the slowing of whole economy wage inequality since the late 1980s. They also conclude that changes in the real minimum wage do not explain much of the secular growth of upper half wage inequality, and that rapid growth of relative demand for skills caused mainly by SBTC and slowdown in relative supply for college graduates since the late 1980s adequately explain wage inequality trends. The question on the supply side is why has growth in the supply of high-skilled labor been so slow?

We reassess the labor market adjustment mechanism. We investigate whether workers' occupational choices are based on trading off rewards against effort requirements. Clearly, because high-income occupations require much effort in the form of higher education, training and long hours, some workers may avoid such occupations. These criteria for occupational choice relate to a strand of modern political philosophy known as responsibility-sensitive egalitarianism theory. From this point of view, persistent income inequality is not necessarily a problem: it arises from differences in workers' effort levels,

which can be acceptable (we call it "fair"). If workers base their occupational choices on such criteria, the labor market cannot eliminate income inequality even in the long run. However, the labor market may be able to reduce income inequality by another means. Occupations that pay more than is warranted, based on worker effort, will attract many job applicants. Then, workers may be paid no more than what is warranted by their effort. In recent studies, empirical methods have been developed to determine fair incomes. Following the empirical method developed by Almås et al. (2011), we derive individual workers' fair incomes, and define "income unfairness" as the ratio of actual income to fair income. Then, we aggregate these levels of income unfairness by occupation group. Our interest is whether the income unfairness levels of each occupation group have strayed from zero in the long run. We use US labor statistics from 1992 to 2015.

We find that workers in occupation groups such as professionals, sales, and production are rewarded based on income unfairness ratios. For these occupations, the ratio has hardly strayed from zero over the past 24 years. However, for other occupation groups, the adjustment of labor supply does not work. Workers in managerial occupations have received much more than their fair income, whereas office workers and those in service occupations have received much less. We also find that workers' educational level and work hours play a central role in whether unfairness levels strayed from zero.

This paper is organized as follows. In Section 2, we describe the empirical method used to calculate a fair income and the income unfairness indicator. In Section 3, we introduce the data source and present an occupation classification. In Section 4, we describe our empirical results and present the contribution analysis. In Section 5, we discuss the relationship between income unfairness and recent labor-market issues such as job polarization and globalization. Section 6 concludes the paper.

2 Empirical Method

2.1 Fair Income

In this section, we show how the fair income of each worker can be calculated. We suppose that there are $N = \{1, \cdots, n\}$ workers in the economy and that worker i is characterized by a vector of response variables x_i^R (e.g. education level, work hours, etc.) and nonresponse variables x_i^{NR} (e.g. age, gender, etc.). We assume that pretax income y_i is determined by the following function:

$$y_i = f(x_i^R, x_i^{NR}).$$

We estimate this income function using cross-section data on workers. We use a log-linear labor income model:

$$\ln y_i = \beta x_i^R + \gamma x_i^{NR} + \epsilon_i.$$

Thus, the income function can be rewritten as:

$$y_i = \exp(\beta x_i^R) \exp(\gamma x_i^{NR} + \epsilon_i).$$

The next step is to construct a worker's claim for redistribution. We apply the generalized proportionality principle developed by Cappelen and Tungodden (2010). The worker's claim for redistribution depends only on each worker's response factors. The nonresponse factors are shared by all workers. We define the worker's claim for redistribution as $g(x_i^R, \cdot)$, and calculate it as follows:

$$g(x_i^R, \cdot) = \frac{1}{n} \sum_j f(x_i^R, x_j^{NR}) = \frac{1}{n} \exp(\beta x_i^R) \sum_j \exp(\gamma x_j^{NR} + \epsilon_j).$$

Then, we derive the fair income of each worker by sharing the total pretax income in the economy by using the worker's claim for redistribution. Letting z_i be the fair income of worker i and letting Y be total pretax income in the economy means that z_i can be

calculated as:

$$z_i = \frac{g(x_i^R, \cdot)}{\sum_j g(x_j^R, \cdot)} Y.$$

2.2 Income Inequality and Income Unfairness

In this section, we define two types of income deviation indicators: income inequality and income unfairness. Income inequality is defined as $e_i = y_i/\bar{y} - 1$, where $\bar{y}$ is average aggregate income. It measures the percentage deviation of worker i's income from the average income. For example, $e_i = 0.2$ means that worker i receives 20% more than the average income. Income unfairness is defined as $u_i = y_i/z_i - 1$. It measures the percentage deviation of worker i's income from his or her fair income. $u_i = -0.1$ means that worker i receives 10% less than his or her fair income. That is, the worker is paid 10% less than is warranted by his or her effort.

We also define two types of aggregate income deviation indicator for each occupation group: occupation income inequality (OII) and occupation income unfairness (OIU). The former is defined as the average of each worker's income inequality e_i conditional on their occupation group. It simply measures the percentage deviation of an occupation average income from average aggregate income. Similarly, OIU is defined as the average of each worker's income unfairness u_i conditional on their occupation group. In this paper, OIU is an important indicator because it measures how attractive the occupation is. In an occupation with a high OIU, payment is disproportionately high, based on workers' effort.

3   Data

3.1   Data Source

The data used for our research are from the March samples of the Current Population Survey (CPS) conducted by the US Census Bureau for 1992 to 2015. The dependent variable is the log of individual earnings, and the independent variables are education level, work hours, age, and dummy variables for gender, race ('black' and 'other'), public sector employment, and metropolitan residence.

Following Almås et al. (2011), we treat education level, work hours, and dummy variables for public sector employment and metropolitan residence as responsible factors, and treat age and dummy variables for gender and race as nonresponse factors.

We include in the sample only persons aged 20–60 years with an annual income of USD 10,000–1,000,000, who worked 20–99 hours per week for 30–52 weeks per year and had at least nine years of education.

The regression coefficients are summarized in Table 1. All response and nonresponse variables have statistically significant signs. The response variables, education, work hours, and metropolitan residence have positive signs, although public sector has a negative sign. Women, black and other race workers tend to earn less than men and white workers.

Table 1: Regression Results

Year	1992	2004	2015
Obs.	27,994	47,684	46,411
Education	0.068225***	0.088962***	0.097294***
Work hours	0.000278***	0.000381***	0.000417***
Metropolitan	0.165825***	0.179773***	0.124423***
Public sector	−0.01709***	−0.06113***	−0.03608***
Age	0.013297***	0.011556***	0.012029***
Women	−0.25485***	−0.23983***	−0.23176***
Black	−0.08573***	−0.10149***	−0.12069***
Other	−0.01682***	−0.0393***	−0.0235***

3.2 Occupation Classification

We classify occupations into six groups: management, professional, service, sales, office work, and production[1]. Because the occupation classification of the CPS changed occasionally over the period under study, we carefully categorize occupations to minimize the impact of these changes. The occupation classification used in this paper is shown in table 2 and 3. According to Jaimovich and Siu (2012), management and professional occupations tend to be highly paid and highly skilled occupations. In contrast, service occupations are low-paid and low-skilled occupations. Sales, office, and production occupations are middle skilled.

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[1]We also defined an occupation group for workers in transportation, but because this category had few workers, we omitted it from the paper.

Table 2: Occupation Classification (1992–2001)

	1990 Occupation groups
Management	Executive, administrative, and managerial
Professional	Professional specialty Technicians and related support
Service	Service occupations
Sales	Sales occupations
Office	Administrative support, including clerical
Production	Precision production, craft, and repair Handlers, equipment cleaners, helpers, and laborers Machine operators, assemblers, and inspectors

Table 3: Occupation Classification (2002–2015)

	2002 Occupation groups
Management	Management, business, and financial operations
Professional	Professional and related occupations
Service	Service occupations
Sales	Sales and related occupations
Office	Office and administrative support occupations
Production	Construction and extraction occupations Installation, maintenance, and repair occupations Production occupations

3.3 Descriptive Statistics

Table 4 reports the descriptive statistics by occupation for year 1992 and year 2015. Most occupations displayed increasing education level; however, service, sales, and production occupations experienced little change. Average work hours decreased by 40 hours over the 24 years. Work hours in service and sales occupations decreased by over 100 hours while production occupations experienced an increase. Although the average age and the proportion of women increased in most occupations, the average age in service occupations and the proportion of women in office occupations decreased.

Table 4: Descriptive Statistics

	Edu.level	Work hours	Age	Prop.women
Year 1992				
Average	13.814	2184.43	37.795	0.401
Management	14.780	2283.05	39.403	0.394
Professional	15.916	2177.07	38.183	0.477
Service	12.800	2140.88	37.506	0.424
Sales	13.900	2296.21	37.241	0.333
Office	13.162	2068.70	37.195	0.788
Production	12.336	2153.43	37.184	0.152
Year 2015				
Average	14.798	2145.35	40.820	0.495
Management	15.561	2275.53	42.481	0.456
Professional	16.328	2119.32	41.157	0.587
Service	13.193	2018.87	38.302	0.548
Sales	14.273	2186.93	39.834	0.441
Office	13.921	2043.12	40.468	0.745
Production	12.674	2169.85	40.384	0.127

Figure 1 shows the evolution of workers in each occupation group. Although the proportions of management and professional workers (i.e., high-skilled) and service workers (low-skilled) have increased over the 24 years, those of other workers (middle-skilled) have decreased. This phenomenon is known as job polarization.
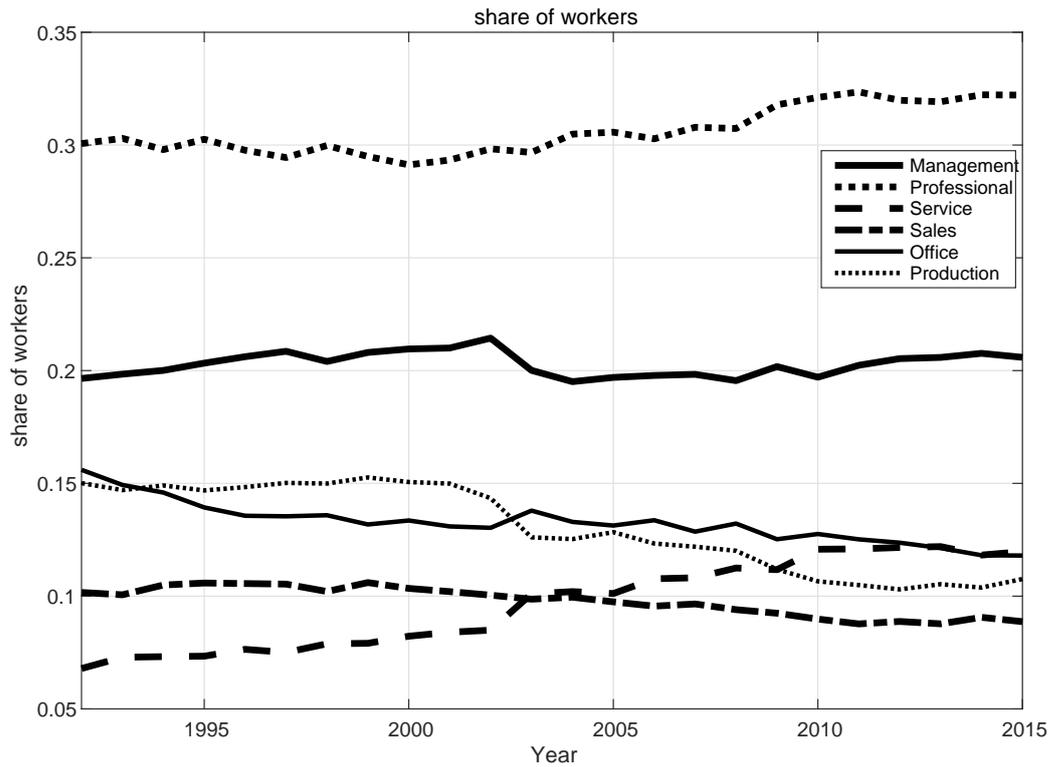
Figure 1: Proportion of Workers

4 Results

4.1 The Evolution of OII and OIU

In this section, we report the empirical results, focusing on the evolution of OII and OIU for each occupation group. Figure 2 shows the evolution of OII for each occupation group from 1992 to 2015. Management occupations have the highest average income, followed by professional, sales, production, office, and service occupations. Workers in management occupations receive 30% more than the average income, whereas those in production occupations receive 20% less and office workers and those in service occupations both receive 30% less than the average income. The time-series data show that income inequality has increased over the past 24 years. Indeed, OII in management occupations

increased by 10 percentage points (pp). In contrast, in the other occupations, except for professionals, OII decreased by 5–10 pp. In 1992, OII differed by 60 pp between the highest- and lowest-ranked occupation groups; by 2015, this difference had increased to 80 pp.
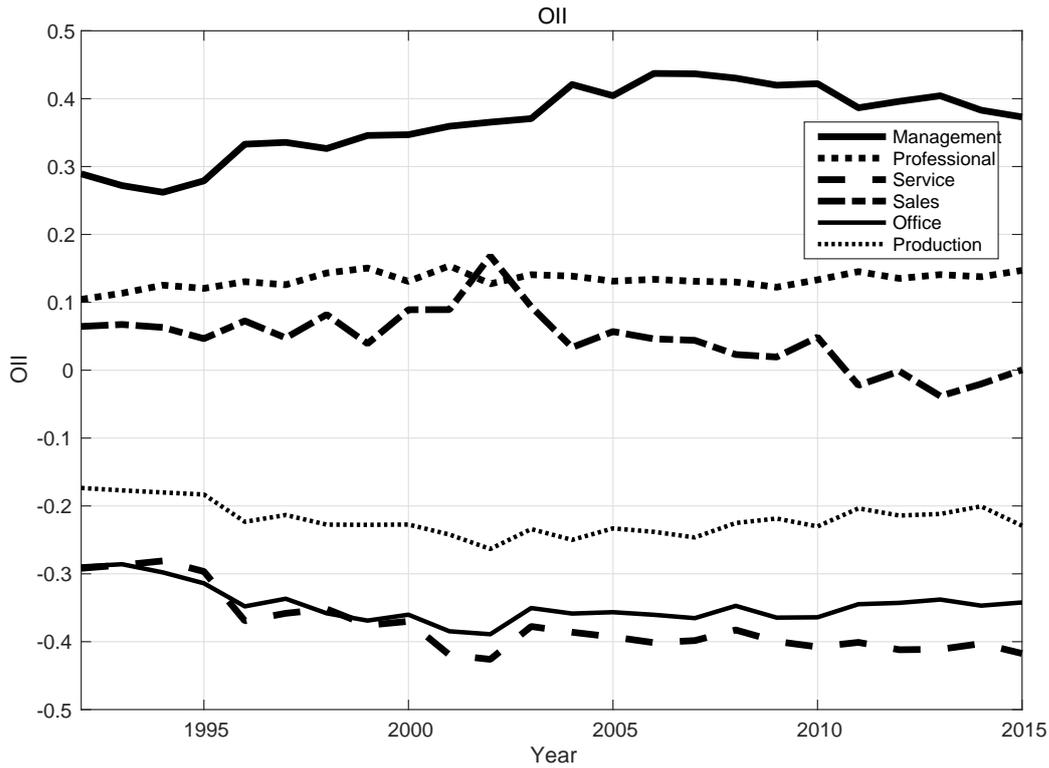

Figure 2: OII

Figure 3 shows the evolution of OIU, which differs from that of OII. Although professional, sales, and production occupations have different average incomes, their OIU values have remained around zero. Whereas the OII values for sales and production declined by 5 pp in the last 24 years, their OIU values hardly changed. The 15% more than their fair income that workers in management occupations received in 1992 had become 25% by 2008. Office workers and those in service occupations received 20% less than their fair income. Figure 2 and 3 indicate that changes in OII have varied roughly twice as much as changes in OIU. These results suggest that some adjustment mechanism may stabilize

changes in OIU relative to those in OII. In the next section, we investigate causes of stabilization of OIU.
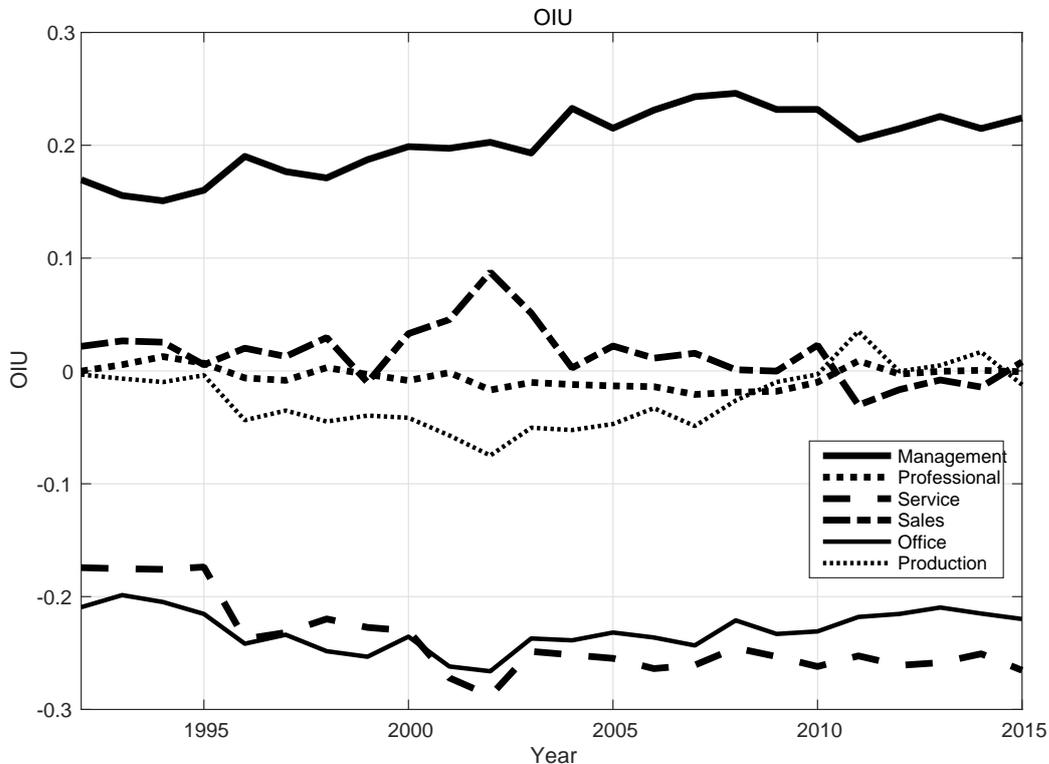

Figure 3: OIU

4.2 Contribution Analysis

Why has OIU in some occupational groups stayed around zero in the long run? In this section, we present a contribution analysis to specify the causes of stabilization of OIU. For this reason, we introduce notation used in the rest of this paper.

We define k as an occupation group (e.g., management, professional, etc.) and $-k$ as all remaining occupation groups without k. $\bar{x}_k^R$ is an average of responsible variables in occupation group k, and $\bar{x}_k^{NR}$ is an average of nonresponse variables in occupation group k. N_k is an observation of k and $\bar{\epsilon}_k$ is the average residual of k .

Second, we construct a reduced-form economy in which there are six occupational

representatives each of whom has average occupational characteristics. We define $\bar{g}(\bar{x}_k^R)$ as an average claim for redistribution in occupation group k:

$$\bar{g}(\bar{x}_k^R) = \frac{1}{N} \exp(\beta \bar{x}_k^R)[N_k \exp(\gamma \bar{x}_k^{NR} + \bar{\epsilon}_k) + N_{-k} \exp(\gamma \bar{x}_{-k}^{NR} + \bar{\epsilon}_{-k})].$$

We calculate an occupation's fair income by using the average claim for redistribution, and then derive the OIU of the reduced-form economy. Figure 4 presents our estimates of OIU under the reduced-form economy. We use this OIU as the benchmark.
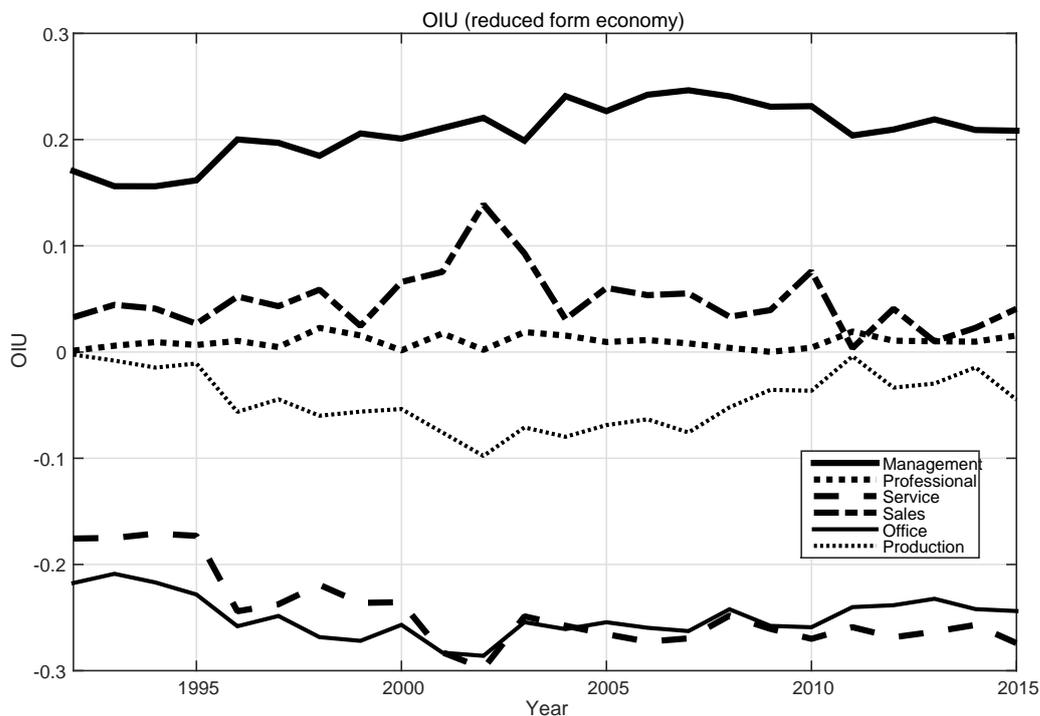

Figure 4: OIU (reduced-form economy)

We suggest three reasons for the value of OIU changing. First, an occupation group in which average income increases, other things being equal, experiences an increase in its OIU. An example is management, in which average incomes have increased during almost every one of the past 24 years. In contrast, average incomes in service occupations have decreased over the same period.

Second, changes in occupation groups' response variables such as average educational

14

levels and average working hours can affect their fair income and thus their OIU. To estimate the effect of changing response variables, we define a counterfactual average claim for redistribution in occupation group k as follows:

$$\bar{g}^*(\hat{x}_{k,j}^R) = \frac{1}{N} \exp(\beta \hat{x}_{k,j}^R)[N_k \exp(\gamma \bar{x}_k^{NR} + \bar{\epsilon}_k) + N_{-k} \exp(\gamma \bar{x}_{-k}^{NR} + \bar{\epsilon}_{-k})],$$

where $\hat{x}_{k,j}^R = (\bar{x}_{k,1}^R, \cdots, \bar{x}_{k,j-1}^R, \bar{x}_{-k,j}^R, \bar{x}_{k,j+1}^R, \cdots, \bar{x}_{k,J}^R)$ is a vector of response factors of occupation k in which an element j is replaced with $\bar{x}_{-k,j}^R$.

We calculate each counterfactual occupation fair income by using $\bar{g}^*(\hat{x}_{i,j}^R)$ for $i = k$ and $\bar{g}(\bar{x}_i^R)$ for $i \neq k$ and derive the difference of OIU from the benchmark case.
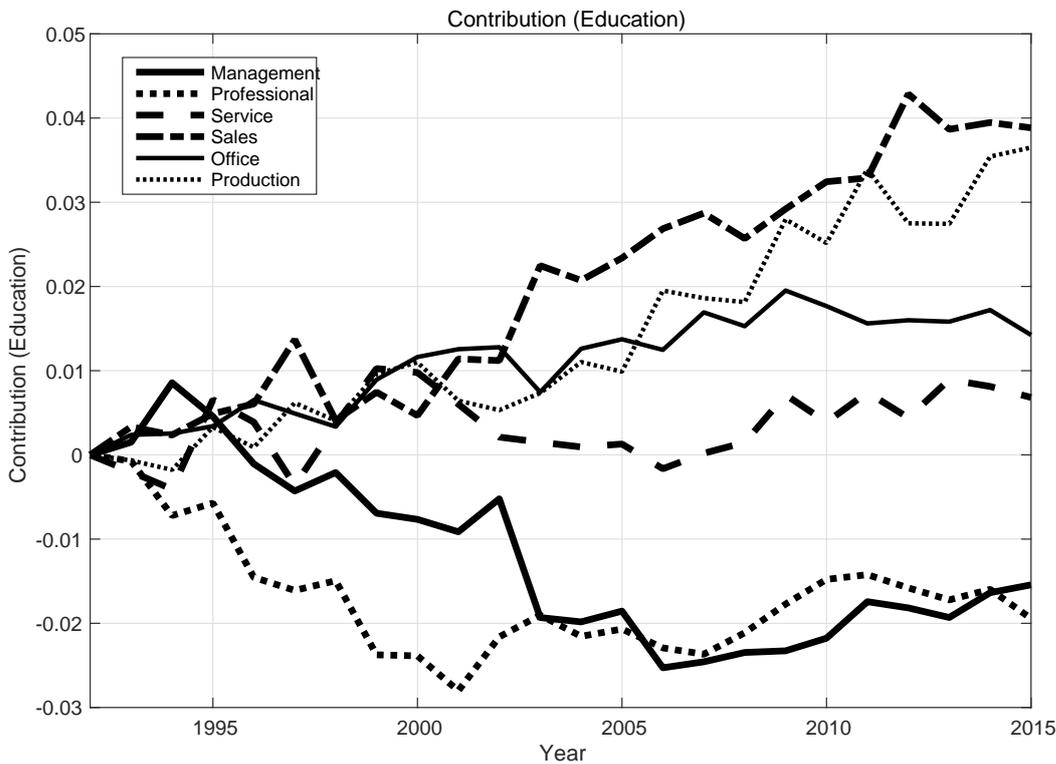

Figure 5: Effect on OIU of changing education level

In Figure 5, we estimate that the increase of sales workers' education level increase their OIU by 4 pp from 1992 to 2015. Although average incomes in sales occupations declined by 6 pp from 1992 to 2015 (see Figure 2), OIU in sales did not change (see

Figure 4). This is because the average education level of sales workers declined over the same period: in 1992, sales workers averaged 0.09 more years of education than workers overall but by 2015, they had 0.51 fewer years than workers in general. Therefore, the declining average education level in sales occupations also decreases their fair income.

Similarly, OII in production occupations declined by 5.5 pp from 1992 to 2015; however, the respective OIU decreased by less than 1 pp. Figure 5 shows that the increase of production workers' education level increases their OIU by 3.5 pp over the same period. In Figure 6, we also estimate an effect on OIU of changing average work hours in each occupation group. The decreasing work hours in service and sales occupations increases their OIU by 1.5 pp.
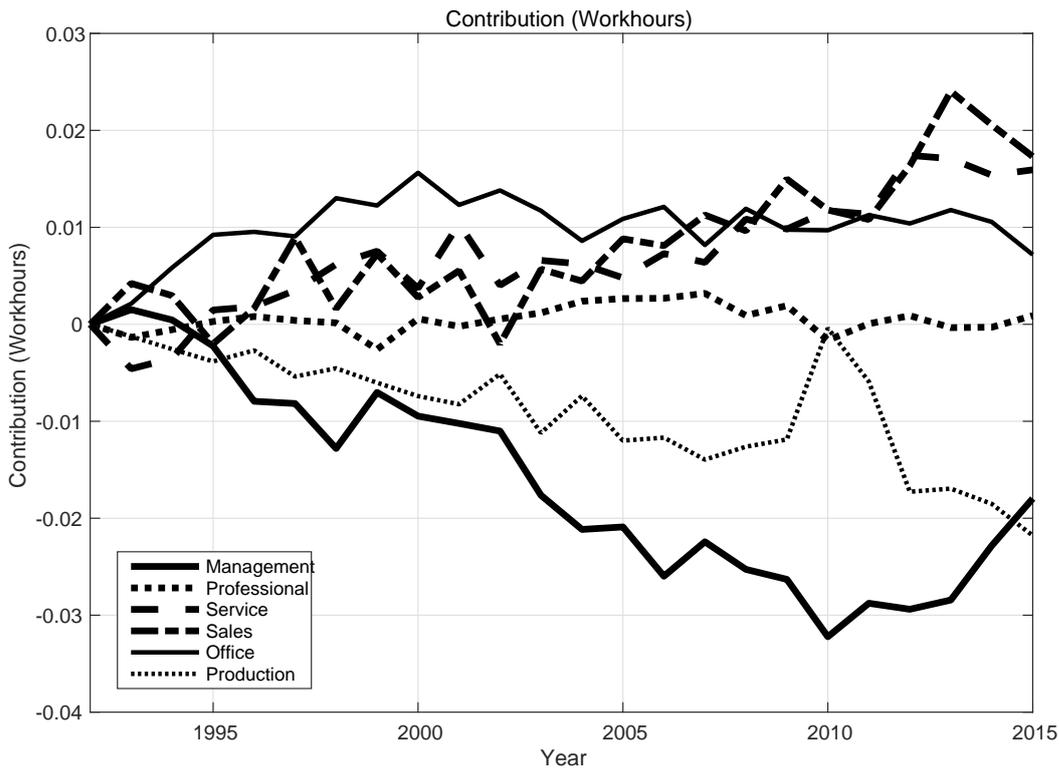

Figure 6: Effect on OIU of changing work hours

Third, changes in occupation groups' nonresponse variables such as workers' average age and the proportion of women workers can affect their OIU. There is a technical

reason for this. When we calculate the fair income of each worker, the effect of their age is distributed over the whole economy. Because older workers typically earn higher incomes, their fair income tends to be low. Therefore, occupation groups in which average age increases experience an increase in their OIU. Intuitively, young workers do not enter unattractive occupations (which have a low OIU value). As a result, the average age of workers in these occupations increases, and this raises their OIU (the "aging effect"). As for the case of changing response factors, we also define $\bar{g}^{**}(\bar{x}_k^R)$ as a counterfactual average claim for redistribution in occupation group k:

$$\bar{g}^{**}(\bar{x}_k^R, \hat{x}_{k,j}^{NR}) = \frac{1}{N}\exp(\beta\bar{x}_k^R)[N_k\exp(\gamma\hat{x}_{k,j}^{NR} + \bar{\epsilon}_k) + N_{-k}\exp(\gamma\bar{x}_{-k}^{NR} + \bar{\epsilon}_{-k})],$$

where $\hat{x}_{k,j}^{NR} = (\bar{x}_{k,1}^{NR}, \cdots, \bar{x}_{k,j-1}^{NR}, \bar{x}_{-k,j}^{NR}, \bar{x}_{k,j+1}^{NR}, \cdots, \bar{x}_{k,J}^{NR})$ is a vector of nonresponse factors of occupation k in which an element j is replaced with $\bar{x}_{-k,j}^{NR}$.

We calculate each counterfactual occupation fair income by using $\bar{g}^{**}(\bar{x}_i^R, \hat{x}_{i,j}^{NR})$ for $i = k$ and $\bar{g}(\bar{x}_i^R)$ for $i \neq k$ and derive the difference of OIU with the benchmark case.
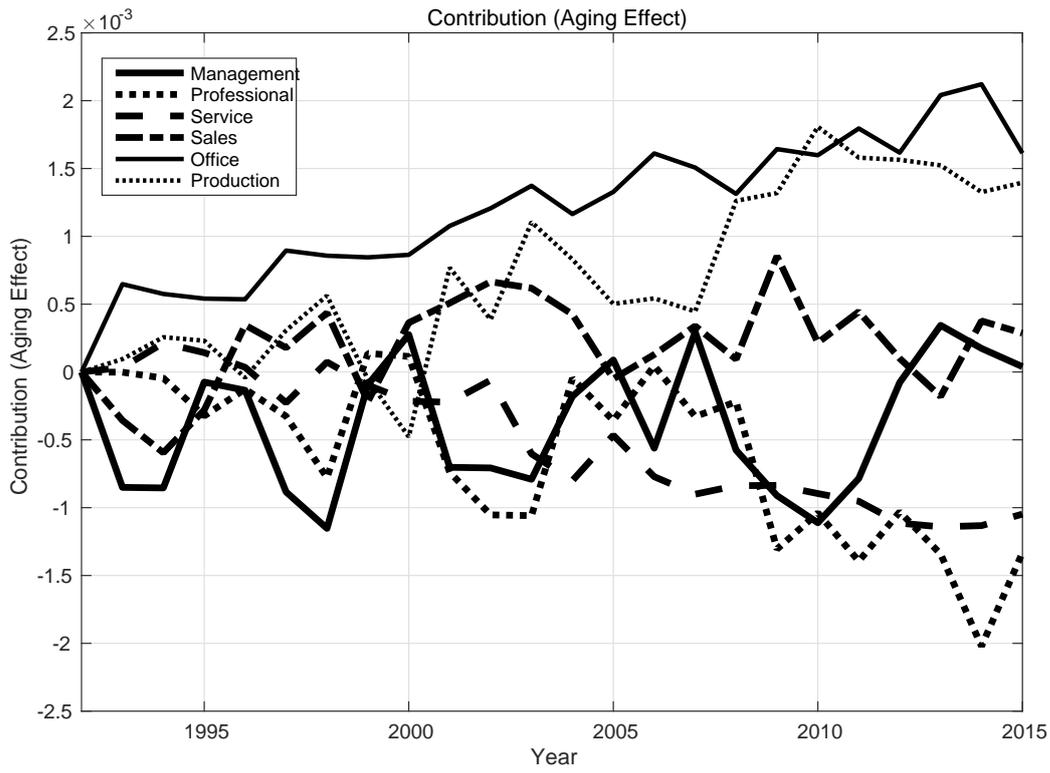
Figure 7: Aging effect

In Figure 7, we estimate the aging effect on OIU in each occupation group, and confirm that increasing the average age in production and office occupations increases their OIU by 0.15 pp from 1992 to 2015. However, the aging effect is very small.
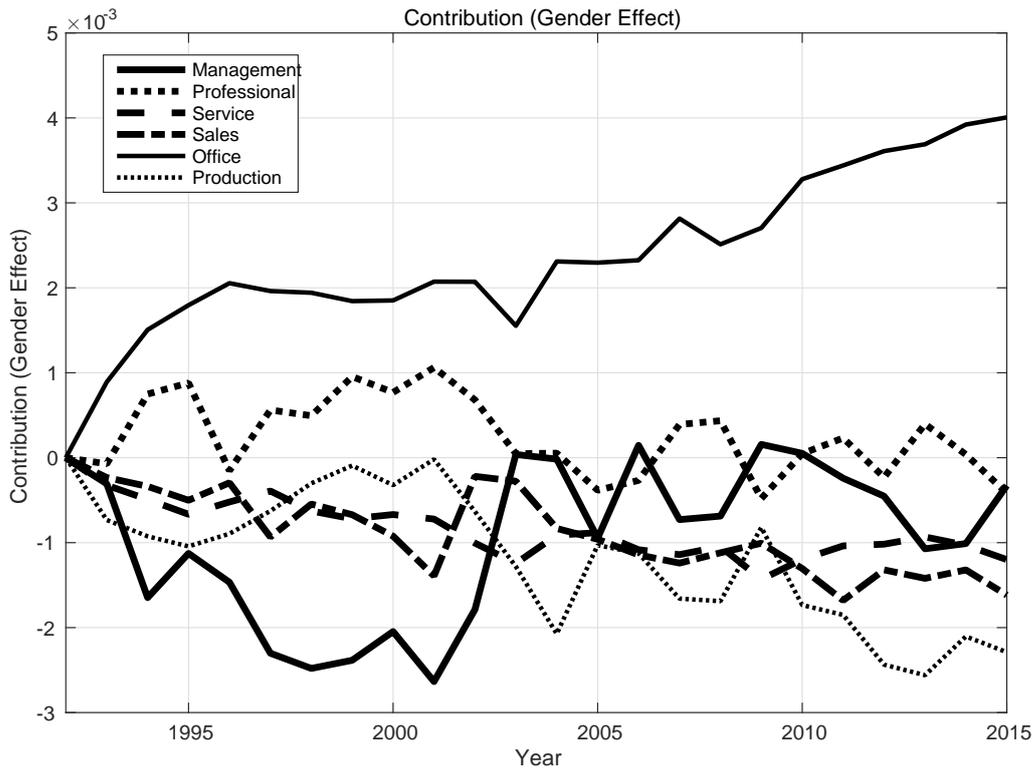
Figure 8: Gender effect

Similarly, in Figure 8, we estimate an effect of the changing proportion of women workers on OIU in each occupation group (the "gender effect"). Figure 8 shows that the decreasing percentage of women in office occupations increases OIU by 0.4 pp. Similar to the aging effect, the gender effect is also small.

5   Discussion

In this section, we discuss the relationship between our research and recent labor-market issues. We first consider the phenomenon known as job polarization. Job polarization refers to a shift from middle-skilled occupations toward high-skilled and low-skilled occupations. Autor, Levy, and Murnane (2003) and Autor, Katz, and Kearney (2006) show that the US has been experiencing job polarization since the 1980s. Goos and Manning

(2007) and Goos, Manning, and Salomons (2009) document job polarization in Europe. In our classification of occupations, the middle-skilled are sales, office workers, and production occupations, and average incomes in these occupations have declined. This has led to workers aging in these occupations: according to our data, the average age of middle-skilled occupations has increased over the past 24 years. In contrast, the average age of workers in service occupations (i.e., low-skilled) has declined relatively sharply. Autor and Dorn (2013) point out that nowadays computers have taken over many of the routine tasks of low-skilled workers, who have consequently transferred to service occupations. This is the reason OIU in service occupations remains low.

Second, we consider why OIU in management occupations remains so high. The theory of Eeckhout and Jovanovic (2012) predicts that openness raises the fraction of managerial jobs in a high-skill economy. The theory indicates that there is a large demand for management workers in the US and other developed countries. This may explain the evolution of OIU in management occupations.

6 Conclusion

In this paper, we reassessed labor-market adjustment using an indicator of occupational income unfairness (OIU). Although an empirically derived unfairness indicator does not necessarily reflect workers' perceived unfairness, OIU in some occupations indicates the existence of a labor-market adjustment mechanism. However, unfairness remains in some occupations, perhaps because it is caused by structural development problems. We also presented a contribution analysis and found that changing education level and work hours mainly explain the stabilization of OIU. The aging effect and the gender effect also contribute to adjusting the level of unfairness, although these effects tend to be small.

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